



**US Army Corps
of Engineers**

Nashville District

ENVIRONMENTAL ASSESSMENT

2003 Experiment – Mussel Relocation
Tennessee River Mile 194.0 – 195.0
Hardin County, Tennessee

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2003 EXPERIMENT - MUSSEL RELOCATION

TENNESSEE RIVER MILE 194.0-195.0

HARDIN COUNTY, TENNESSEE

SEPTEMBER 2003

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Acronyms and Abbreviations

Corps	U.S. Army Corps of Engineers
EA	Environmental Assessment
EL	Elevation – feet above mean sea level
FWCA	Fish and Wildlife Coordination Act
FWS	U.S. Fish and Wildlife Service
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
ppm	parts per million
TRM	Tennessee River Mile
SHPO	State Historic Preservation Office
TDEC	Tennessee Department of Environment and Conservation
TDNH	Tennessee Division of Natural Heritage
TRM	Tennessee River Mile
TWRA	Tennessee Wildlife Resources Agency
TVA	Tennessee Valley Authority
USGS	U.S. Geological Survey
WPC	Tennessee Division of Water Pollution Control

1.0 INTRODUCTION

1.1 Background

This Environmental Assessment (EA) supplements the original document - Environmental Assessment, Experimental Mussel Relocation, Tennessee River Mile 194.0-195.0, Hardin County, Tennessee, September 2002. The Finding of No Significant Impact (FONSI), including Statement of Findings, and Findings of 404 (b)(1) Guidelines Compliance for the 2002 EA, were signed on September 7, 2002, and have been referenced.

Inter-agency meetings and the rationale for considering mussel relocation using dredging equipment and modified dredging operations are well documented in the 2002 EA. In summary, a mussel relocation method had to be developed that could move over one million mussels in a safe, efficient, and timely manner prior to unavoidable maintenance dredging. The concept of using dredging equipment to remove mussels is analogous to sod cutting operations. A clamshell dredge would remove the top layer of substrate containing the mussels. Three treatments were considered. Treatment 1 used full dredge buckets and a full dump scow. Treatment 2 used full dredge buckets placed one layer deep in a dump scow. Treatment 3 used partial buckets of substrate placed one layer deep in a dump scow. For all Treatments, the dump scow was hydraulically operated to slowly open from the bottom to disperse mussels and substrate in a thin layer.

This experimental mussel relocation method was implemented on September 17, 2002. Preliminary results indicated that percent mortality could be small. However, the credibility of this assessment was imperiled by data gaps and incomplete implementation of the written protocols. At the request of Tennessee Wildlife Resources Agency (TWRA), the experiment was suspended pending redesign of the experimental protocols.

On February 13, 2003, an inter-agency meeting was held to discuss preliminary results of the 2002 experiment performed on September 17, 2002. Agencies included TWRA, U.S. Fish and Wildlife Service (USFWS), Tennessee Valley Authority (TVA), U.S. Geological Survey (USGS) and the Corps of Engineers – Nashville District (Corps). During this review, the agencies significantly redesigned the 2002 protocols to address field implementation and data gaps. Major changes included detailed tasks, quality assurance/quality control (QA/QC), and a field contingency plan to address unforeseen events. The redesigned protocols can be found in Appendix A.

The environmental impacts and consequences of the 2003 experiment are expected to be the same as the 2002 experiment and therefore would have no significant impact to any of the listed resources. All field conditions, equipment, and experimental site (Tennessee River Mile (TRM) 194.0-195.0) would be the same for both the 2002 and 2003 experiments. However, the amount of river substrate relocated in the 2003 experiment would be about one-tenth (100 cubic yards) of the river substrate relocated during the 2002 experiment (1,000 cubic yards). This action resulted because the agencies identified a significant data gap. Impact assessment needed to focus on the action of the clamshell dredge and its affect on mussels, both inside and under the bucket as it dredged the river bottom. As a result, more time will be spent evaluating the volume of substrate collected within the bucket.

Figure 1. Vicinity Map. Location of Experimental Site within Tennessee, near Crump, TN.

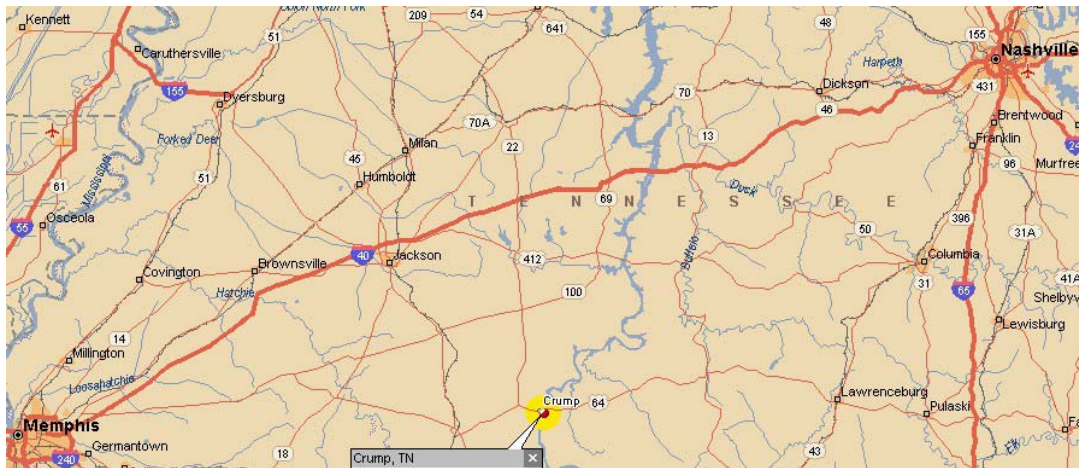
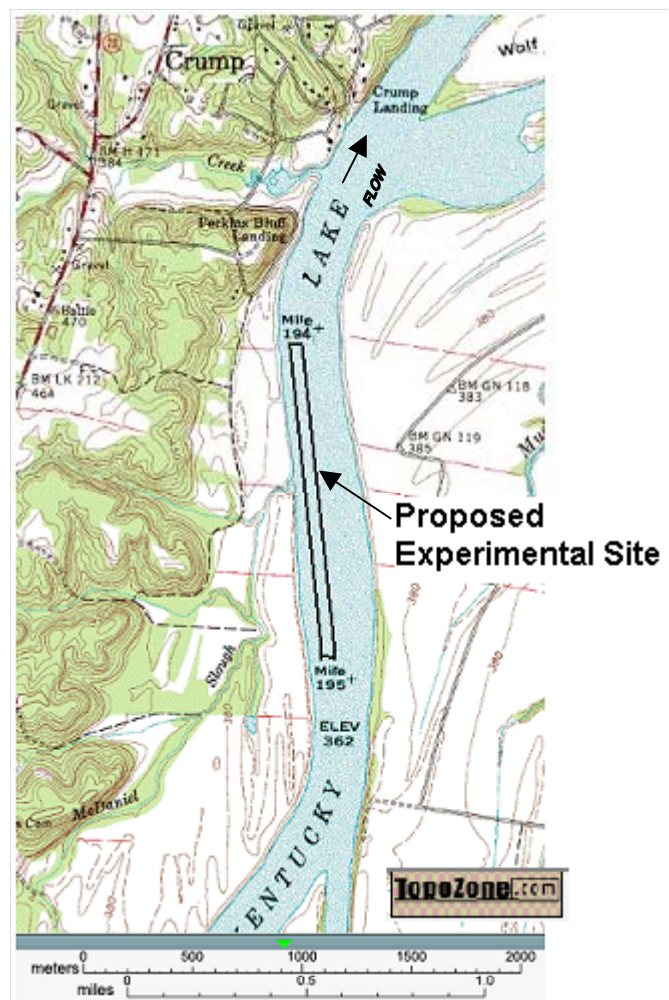


Figure 2. Experimental Site Location just upstream Crump, TN, between Tennessee River Miles 195.0 and 194.0, on the Left Descending Bank. Water depth would be variable depending on pool height and scow displacement.

USGS Topographic 7.5-Minute Series Map: 13 NE
Pittsburg Landing, TENN, 1972



The 2003 Environmental Assessment (EA) has been prepared to address any new information regarding potential environmental effects of the proposed 2003 experiment and its consideration as an alternative method to relocate mussels. The 2003 EA incorporates information gathered during the 2002 experiment. The No Action Alternative has also been considered. This EA is prepared in accordance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality's (CEQ) regulations published in 40 CFR Part 1500, and Engineer Regulation 200-2-2 *Procedures for Implementing NEPA*.

1.2 Authority

The Rivers and Harbors Act of July 3, 1930 (46 Stat. 927) authorized the permanent improvement of the Tennessee River to a navigable depth of nine feet at low water from the mouth to Knoxville, Tennessee. The Tennessee Valley Authority Act of 1933 (16 U.S.C. §§ 831-831ee) authorized TVA to provide a nine-foot channel in the Tennessee River from Knoxville to its mouth. Since passage of the Tennessee Valley Authority Act of 1933 the Corps of Engineers, in cooperation with TVA, has maintained navigation channels on TVA projects by performing necessary maintenance dredging operations. This division of responsibility is outlined in the October 26, 1962 *Memorandum of Agreement between the Department of the Army and Tennessee Valley Authority for Construction, Operation, and Maintenance of Navigation Facilities on the Tennessee River and its Tributaries*. This MOA assigns responsibility for maintenance of the main navigation channel to the Department of the Army, and provides that TVA will be responsible for new facilities and recreational navigation channels. In addition to having special expertise in mussel management, TVA also views the provision of an open channel as carrying out part of TVA's statutory mission. TVA is a cooperating agency in this NEPA process.

1.3 Purpose and Need for Action

The purpose of the experimental mussel relocation method is to safely relocate large and unavoidable mussel communities prior to maintenance dredging activities. There is no feasible alternative to working in the river. A safe, efficient, timely, and holistic mussel relocation method is needed because large mussel communities are sometimes found at maintenance dredging sites where shoaling and natural sand and gravel deposition occur. Maintenance dredging is required to maintain a safe and open authorized navigation channel.

The purpose of the 2003 experiment is get an accurate assessment of the effects of this relocation method on individual mortality and the ability to remove all size classes of mussels found within the substrate. Some mortality occurs with any relocation method. The proposed 2003 experiment is designed to maximize safe mussel removal and to minimize death, injury, or stress associated with handling, air exposure, transport time, and potentially deep burial at selected placement sites.

1.4 Process

The Corps performs regular inspections and annual hydrographic and bathymetric surveys to determine the need for channel maintenance dredging. Areas where the natural sedimentation processes of the river have caused an accumulation of riverbed materials that would eventually obstruct navigation along the river are scheduled for dredging. Additional details

regarding this site selection process and typical dredging operations are found in the 2002 EA.

The 2003 experiment would use redesigned protocols, modified dredging operations, and dredging equipment to relocate mussels. This process involves the use of a clamshell dredge to remove the top layer of river substrate that contains the majority of the mussel community of all size classes. A detailed discussion regarding the experimental process and redesigned protocols are found in Section 2.1 Proposed Action – Experimental Dredging, of this EA.

1.5 Experimental Site Location

An experimental site was located by TWRA in 2002 between TRM 194.0-195.0 along the left descending bank. TWRA was familiar with the area and could collect field information, perform an accurate site evaluation, and locate appropriate test dredge and disposal sites within this river mile. This river mile is currently permitted for commercial sand and gravel dredging.

1.6 Experimental Site Setting

Current environmental conditions within the experimental site (TRM 194.0-195.0) are essentially the same for both the 2002 EA and 2003 EA. The surrounding countryside is primarily agricultural with large patches of wooded areas. The riverbanks are fairly steep, benching up to a wide bottomland crossed by a number of creeks and sloughs.

The topography of the river bottom within the experimental area varies from slightly sloping to irregular furrows. The last time commercial dredging occurred was in 2001 during exploration dredging to evaluate the quality of the river substrate for commercial use.

The 2002 test dredge area was located off shore near TRM 194.8. The river bottom gently sloped with a water depth ranging between 20 to 25 feet deep. The substrate was composed of gravel and sand. The 2002 test disposal site was located off shore near TRM 194.6. The river bottom resembled a shallow bowl with a water depth range between 20 to 30 feet deep. The substrate was composed of sand and gravel. The 2003 dredge and disposal sites would be located in close proximity to these same sites.

2.0 PROPOSED ALTERNATIVES

It is anticipated that moving communities and a portion of their current habitat to appropriate placement sites would expand mussel habitat and beds. Additionally, any juveniles that would be missed during traditional hand removal and relocation by divers would be collected by the experimental method and have a chance to grow within the relocated community. The long-term benefits are expected to outweigh the short-term, immediate, and highly localized impact resulting from the experimental method. It is expected that mussels and other shellfish with time, would re-colonize the dredge area. The experimental relocation method, if successful, could be used as a mitigation measure under NEPA, the Fish and Wildlife coordination Act, and considered a reasonable and prudent measure under the Endangered Species Act.

2.1 Alternative 1 - Proposed Action – 2003 Experiment

Prior to any action, divers would use timed searches and total substratum 0.25 square meter quadrats to collect qualitative and quantitative mussel data within the designated dredge and disposal sites. Qualitative data would provide information regarding substrate condition and dispersal pattern of the mussels. Quantitative data would provide estimates of mussel densities and recent recruitment. A sub-set of non-listed mussels would be used in a mark and recapture study.

The Corps - Nashville District fleet, would perform the experimental dredging and disposal. A clamshell dredge and split-hulled scow would be used in the experiment. The material would be placed in a single layer within a split hulled dump scow containing water and moved to a proposed placement site. The scow would align perpendicularly to the bank. The bottom of the dump scow would be opened slowly to allow the material to spread on the river bottom in a thin layer. This technique would prevent deep burial of the mussels and would allow them to migrate to the substrate surface. It is anticipated that large gravel and large mussels would settle first followed by the lighter coarse sand and young mussels. In this way, the majority of the mussels, and their sand and gravel habitat, would be relocated quickly and without excessive handling or deep burial. Two Treatments would be employed. One Treatment would use full buckets while the second Treatment would use partial buckets. Both Treatments would place the material in a single layer within the dump scow for transport and placement in the disposal area.

A significant redesign occurred in processing material within the clamshell bucket. One to three full, and one to three partial buckets of material would be washed through a series of stacked screens with mesh sizes of 3, 1½, ½, and ¼ inch. A sub-sample of the washed fines would be sampled to look for the presence of juvenile mussels that were less than ¼ inch diameter. Mussels would be picked from the screens. They would be identified, counted, sized by group, and assessed for damage. Use of the clamshell dredge is analogous to a ponar dredge sample; however, the clamshell dredge bucket is designed to hold approximately 3 cubic yards of material.

Marked non-listed mussels would be used in this experiment for a mark and recapture study. Marked mussels would be placed in the test dredge site. This would allow comparison of marked mussels remaining in the dredge site, and mussels dredged, transported, and dispersed in the disposal site.

The proposed 2003 experiment would minimize handling of individual mussels and may have the best potential to collect several mussel size classes with the top 1-foot of river substrate. It is usually assumed that mussels will all be killed using dredging equipment. Mortality could be caused by action of the clamshell, or by burial or desiccation while the material is being held or transported. In addition, mussels could be killed if the material is placed in an inappropriate area. A portion of mussels removed by any method will incur some damage, injury, or death. For individuals, survival is expected to be best when individuals are minimally handled. For a population, greatest well-being can be expected when all size classes are represented in that population.

2.2 Alternative 2 - No Action

The 'No Action' alternative would involve no federal action at this time. Current methods of mussel relocation would remain limited, especially for removing large numbers of mussels. Currently the most common method of mussel relocation uses hand removal by divers. This method entails handling large individual mussels several times. Several years of size classes are lost because of the inability to see them or not enough time to collect them.

A No Action would not have a less adverse impact on the aquatic system in the long term. As shoaling continued to lessen the width and depth of the navigation channel, barges eventually drag along the bottom, crushing the aquatic community. In the event of barge grounding, emergency measures to free barges could be more devastating to the aquatic community because any means is employed to free barges. Frequent groundings could constitute a hazard requiring emergency dredging activities, which may not be as protective of the aquatic system as planned maintenance dredging operations.

3.0 AFFECTED ENVIRONMENT

3.1 Water Quality

The Tennessee 2002 305(b) includes the Tennessee River segment between miles 194.0 – 195.0. This document reports that the water quality is assessed as good and that this portion of the river supports all its designated uses. These designated uses are: Domestic Water Supply, Industrial Water Supply, Fish & Aquatic Life, Recreation, Irrigation, Livestock Watering & Wildlife, and Navigation. Four dischargers are located within the 11-mile river reach upstream of the proposed experimental site.

3.2 Aquatic Resources

The Pickwick Dam tailwater is renowned for its fishery and commercial mussel harvests. Flows are relatively high and the main channel has a shifting bed load of coarse sand and gravel. Where the sediments settle, the resulting sand and gravel substrate constitutes excellent aquatic habitat. River sand and gravel are also natural resources. This substrate is considered the best road aggregate material. Commercial extraction operations have likely been an additional factor responsible for changes in aquatic habitat conditions. Recent modifications to Department of the Army Permits for commercial sand and gravel dredging have restricted extraction operations to specific locations on the Tennessee River. The experimental project site is located between TRM 194.0 – 195.0. This river segment is currently permitted for commercial sand and gravel extraction.

In 2001, TVA rated the ecological health of Kentucky Reservoir as good. The fish community was rated as good based on the large number and diversity of healthy fish collected. Monitoring results rated the benthic community as good due to the diversity of organisms collected.

The river reach below Pickwick Lock and Dam has historically supported major freshwater mussel populations. A Mussel Sanctuary was established by TWRA below Pickwick Lock and Dam at TRM 206.7 downstream to TRM 201.9. The river reach below the sanctuary is valued for the high quality and density of commercial mussels.

A species list was compiled after the 2002 experiment (Table 1). Mussels were collected using timed searches, 0.25 sq. m. quadrat samples, and a QA/QC follow-up survey by TWRA.

Table 1. Mussel species collected during the 2002 Experiment.

Preliminary results of mussel species and numbers collected on September 17, 2002, TRM 194 – 195, Hardin County, Tennessee. Bold type indicates listed species.

Common Name	Scientific Name	Number	Common Name	Scientific Name	Number
Ebonyshell	<i>Fusconaia ebena</i>	1057	Washboard	<i>Megalonaias nervosa</i>	10
Pimpleback	<i>Quadrula pustulosa</i>	181	Pink Mucket	<i>Lampsilis abrupta</i>	4
Monkeyface	<i>Quadrula metanevra</i>	103	Fragile Papershell	<i>Leptodea fragilis</i>	4
Butterfly	<i>Ellipsaria lineolata</i>	101	Rock Pocketbook	<i>Arcidens confragosus</i>	1
Purple Wartyback	<i>Cyclonaias tuberculata</i>	56	Pocketbook	<i>Lampsilis ovata</i>	1
Elephantear	<i>Elliptio crassidens</i>	35	Ohio Pigtoe	<i>Pleurobema cordatum</i>	3
Mapleleaf	<i>Quadrula quadrula</i>	44	Rabbitsfoot	<i>Quadrula cylindrica</i>	1
Pink Heelsplitter	<i>Potomilus alatus</i>	27	Fawnsfoot	<i>Truncilla donaciformis</i>	5
Black Sandshell	<i>Ligumia recta</i>	21	Paper Pondshell	<i>Utterbackia imbecillis</i>	3
Threehorn Wartyback	<i>Obliquaria reflexa</i>	49	Wabash Pigtoe	<i>Fusconaia flava</i>	1
Threeridge	<i>Amblema plicata</i>	12	Fanshell	<i>Cyprogenia stegaria</i>	1
Total Number of Individuals: 1720					
Total Number of Species: 22					

3.3 Terrestrial Resources

The landuse surrounding TRM 195.0-194.0 is dominated by agriculture. Row crops flank both sides of the river. There are small bands of riparian woods adjacent the river on top of the bank. Wildlife would be expected to include white tailed deer (*Odocoileus virginianus*), raccoons (*Procyon lotor*), rabbits (*Oryctolagus cuniculus*), opossum (*Didelphis virginiana*), squirrels (Sciuridae), reptiles, and waterfowl. These animals have adapted to areas of high human activity.

3.4 Endangered and Threatened Species

During a 2002 TWRA field reconnaissance for test sites, one Pink mucket (*Lampsilis abrupta*) was collected within the experimental area. This find initiated a request for consultation under Section 7 of the Endangered Species Act that resulted in a Biological Opinion and Take for the 2002 experiment.

During implementation of the 2002 experiment, four Pink muckets (*Lampsilis abrupta*) were collected. The listed mussels were unharmed and handed over to TWRA. One Fanshell (*Cyprogenia stegaria*) was found during a follow-up survey by TWRA. All the collections were below the take documented in the 2002 Biological Opinion.

3.5 Cultural Resources and Historic Properties

Based on a letter from the SHPO regarding the 2002 experiment, no National Register of Historic Places or eligible properties would be affected by this proposal. It is expected that the same findings would apply to the 2003 experiment.

3.6 Navigation and Safety

The proposed 2003 experiment would be located outside the authorized channel.

3.7 Contamination

The TVA ecological health rating in 2000 noted that sediment within the Kentucky Reservoir was rated as good. A good rating means that the reservoir bottom is free of pesticides and that PCBs and metal concentrations are within expected background levels. Currently there are no swimming or fish consumption advisories within the project area.

3.8 Air Quality

The proposed experimental site is within an attainment area under the Clean Air Act.

3.9 Floodplains

The proposed activities occur within the Tennessee River and associated floodplain. Water levels are generally controlled by the operation of Pickwick Dam. Both the backwater effects from Kentucky Reservoir and river flows can affect floodwater heights. For Kentucky Reservoir, the winter pool elevation is 354.0 and the summer pool elevation is 359.0. The 100-year and TVA Flood Risk Profile (FRP) elevations at TRM 195.0 would be 398.4 and 400.7 respectively. At this location, the FRP is equal to the 500-year flood elevation.

3.10 Environmental Justice and Socioeconomics

In 2000, minority populations in Hardin County comprised nearly 5% of the total population.

This representation is below 50%, which identifies the significant presence of a minority population. The 1999 poverty level in Hardin County was about 18.8%. This level was above the state average of 13.5%, but below the Census Bureau's poverty threshold of 20%, which is used to identify low-income populations.

Based on the 2000 U.S. Census, Hardin County contained approximately 25,600 residents. This represents about 0.4 % Tennessee's total population (5,790,000). The 2000 median income was \$24,500, which was below the State median (\$30,500).

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Water Quality

Water quality effects resulting from the proposed action – 2003 experiment, would include temporary, short-term, and highly localized periods of turbidity and suspended solids. Material at both the test dredge and disposal sites consist of cobble, gravel and sand. Given the large particle size, suspended solids would settle out quickly. This effect would not impair designated uses nor release any contaminated sediment into the water column. Compared to the amount of turbidity and suspended solids observed during flooding conditions, the effects caused by the 2003 experiment would be negligible. Four dischargers are located upstream of the proposed experimental site. Potential pollutants could stress the mussel populations resulting in increased vulnerability to other effects.

Under the no action alternative, site-specific water quality would remain unchanged.

4.2 Aquatic Resources

The primary adverse impact resulting from the 2003 experiment would be to the aquatic organisms and their habitat, during the excavation, disruption, relocation, and covering of the substrate. Removal and placement of material would result in a temporary reduction in the local density and distribution of the benthic organisms. This impact is unavoidable, but is not likely to affect the continued existence of these benthic organisms since many similar populations exist throughout the Tennessee River system. Fish are mobile and would likely avoid the experimental site, but would return after the proposed experiment. Fish spawning activities would not be affected since the experiment is scheduled for early fall.

Precautions would be taken to minimize impact to resident freshwater mussel populations. These safeguards are outlined in Section 5 – Environmental Commitments, in this EA. The total area affected by the 2003 experiment would be approximately ¼ surface acre. This footprint size is considered small when compared to the total area of similar habitat located in the Tennessee River system. The test dredge site would be expected to re-colonize quickly due to natural drift from upstream. Water temperature in September is expected to be greater than 60° F, when mussels have increased mobility and the best chance to migrate through a thin layer of substrate.

Under the No Action alternative, aquatic organisms and their habitat would not be disturbed.

4.3 Terrestrial Resources

The proposed experiment would occur within the river. Disturbances to terrestrial wildlife would be temporarily. These animals are mobile and could seek food elsewhere. On completion of the 2003 experiment, wildlife would be expected to return to pre-experiment conditions. Therefore, impacts to terrestrial wildlife would not be expected.

4.4 Endangered or Threatened Species

Details regarding communication and coordination among the resource agencies has been provided in the 2002 EA. A summary of events regarding listed species and new information collected from the 2002 experiment is provided in this section.

On May 22, 2002, TWRA conducted a mussel survey in the proposed experimental area. They found, and relocated, one listed species, a pink mucket (*Lampsilis abrupta*). The Tennessee Department of Environment and Conservation, Natural Heritage Section, provided a list of mussel species that might be found in the experimental site, including the Pink mucket.

In accordance with Section 7 of the Endangered Species Act, and conditions specified in the commercial sand and gravel permit, the Corps and TVA initiated consultation on June 11 2002, and formal consultation via a letter dated July 24, 2002. On September 9, 2002, the USFWS issued a Biological Opinion concluding that the 2002 experiment was not likely to jeopardize the continued existence of the listed mussel species, nor likely to destroy or

adversely modify designated critical habitat. In conclusion, the Coordination Act and Section 7 of the Endangered Species Act had been fulfilled. An Incidental Take was granted for the following listed species: "...one individual each of the orange-foot pimpleback, white wartyback, fanshell, ring pink, cracking pearly mussel, and rough pigtoe, will be incidentally taken. Because it has a higher likelihood of inhabiting the action area, we believe that no more than five pink mucket pearly mussels will be incidentally taken."

A preliminary species list and number was compiled after the 2002 experiment (Table 1.) The list and counts revealed that four endangered Pink muckets (*Lampsilis abrupta*) and one endangered Fanshell (*Cyprogenia stegaria*) were located in both the test dredge and disposal sites. None of these endangered species were harmed by the experiment.

The 2003 experiment would be smaller than the 2002 experiment. The 2003 experiment would affect 1/10 volume (100 cubic yards) of the river substrate than the 2002 experiment (1,000 cubic yards). The 2003 experiment would disturb less than ½ of the bottom surface area (¼ acre) than the 2002 experiment (over ½ acre). Given this reduction in volume and area, the risk of encountering listed species is substantially reduced. It is therefore anticipated that the USFWS would concur with the Corps and TVA findings that the 2003 experiment would not likely jeopardize the continued existence of the listed mussel species, nor likely to destroy or adversely modify designated critical habitat. The incidental takes noted above would be protective of listed species encountered during the 2003 experiment.

4.5 Cultural Resources and Historic Properties

The 2002 experiment was coordinated under Section 106 of the National Historic Preservation Act. In a letter dated June 13, 2002, the Tennessee SHPO concluded that there were no National Register of Historic Places listed or eligible properties affected by the 2002 experiment. All proposed activities occur off shore in open water. Therefore the SHPO had no objections in proceeding with the 2002 experiment. The 2003 experiment is also being coordinated with the Tennessee SHPO. The same proposed experimental site (Figure 2.) used for the 2002 experiment, would also be used for the 2003 experiment. It is therefore anticipated that the SHPO would likely have no objections in proceeding with the 2003 experiment.

4.6 Navigation and Safety

Navigation and safety are not expected to be affected by the 2003 experiment. The experimental site is located outside the navigation channel. However, to ensure the safety of personnel involved with the proposed 2003 experiment, the selected dredge and disposal areas would be flagged to prevent general public access. Additional flagging would be used when divers perform work in accordance with the Corps safety manual. Noise, vibration, and wake could result from dump scow and towboat activities within the proposed experimental site. These effects would be unavoidable but would be of short duration and limited area.

While the 2002 experiment was underway, increased coordination occurred between the Corps Regulatory Office and commercial sand and gravel operations. These companies agreed to support this experiment and complied with a request to avoid TRM 194.0-195.0 for

up to 5 years. This cooperative action would allow follow-up monitoring for the dredging experiments.

4.7 Contamination

Contamination is not expected to result from the proposed action (2003 experiment). The river substrate consists of clean cobble, gravel, sand, and some fines. Due to the type and particle size of the material, contaminants are not expected to adhere to the particles. The surrounding area is predominantly agricultural with no obvious source of contamination. The no action alternative would also have no affect on contamination.

4.8 Air Quality

With the proposed 2003 experiment, or with the no action alternative, air quality would not be affected. The proposed experimental site is within an attainment area under the Clean Air Act. Short-term, localized impacts resulting from equipment exhaust emissions would be negligible and is not expected to affect the general air quality within Hardin County.

4.9 Floodplains

The proposed project involves dredging about a 1 to 3 feet of the river substrate along with the resident mussels. The material would be re-deposited within the experimental site a short distance downstream from the dredging site. For compliance with Executive Order 11988, dredging is considered to be a repetitive action in the floodplain that should result in minor impacts if the excavated material is spoiled outside of the floodplain. However, for this experiment, the mussels must be relocated in water and in a substrate condition similar to the dredging site from which they were removed. Therefore, there is no practicable alternative to relocating the material back into the reservoir. Adverse impacts would be minimized because the river bottom elevation and the channel configuration at the relocation site would not be expected to change enough to increase flood elevations.

4.10 Environmental Justice and Socioeconomics

The proposed action would not present a disproportionate adverse impact on any segment of the population, including minority or low-income people or communities. The aquatic resources are accessible to all citizens regardless of race, color or creed. Commercial operations involving mussel collections or sand and gravel extraction would not be significantly affected. These activities could continue to operate in other reaches of the river. The footprints of the proposed test sites cover less than ¼ acre, which is significantly smaller than the total available area open to these commercial activities. If successful, the experimental relocation method could be beneficial to shell industry. A safe way to relocate large numbers of mussels would sustain this resource and would aid its availability to that segment of the population that depends on this resource for a living.

4.11 Cumulative Effects

The cumulative effects of the 2002 experiment and other actions have been described in the 2002 EA and are summarized in this 2003 EA. The potential resources cumulatively affected by the experimental relocation project are mussels, sand and gravel habitat and navigation.

Human activities within the last 50 years have exerted cumulative impacts on the aquatic ecosystem. Populations demanded electricity, navigation, water supply, flood control,

recreation, commercial sand and gravel, flow augmentation for wastewater assimilation, and commercial fishing and musseling. These demands were affected, some more positively than others, when the river was altered from a free-flowing river system to a slower and deeper reservoir system with the construction of a series of dams.

Over the last 50 years, about one-fifth of all native freshwater mussel species (297 taxa) are federally listed as endangered or threatened. Many more are being considered as candidates for listing. Endemic freshwater mussels were arguably hit hardest by the cumulative impact resulting from the physical and water quality changes in the river system. Species that could not adapt to the new flow, water quality, and fine-grained habitat were extirpated or became extinct, endangered or threatened. Any activity affecting them or their habitat became a concern.

Over the last 50 years, approximately 30 sites have been dredged within the Tennessee River. These sites add up to approximately 40 river miles (6% of the navigation channel) that required periodic maintenance dredging. Some sites have been dredged many times (every 5-8 years) due to the high rate of bedload accumulation. At some dredge sites, mussels have been found in very high concentrations. This situation developed because maintenance dredging was postponed for years beyond the normal cycle. To compensate for the progressive shoaling, mussel impact was avoided because the U. S. Coast Guard moved navigation markers into deeper water, forcing traffic to move outside the authorized channel. The expanding shoals have forced channel markers to move far enough riverward that grounding risks could occur on either side of the channel. With increasing risk, these shoals and resident mussel populations can no longer be avoided. Relocating the mussel beds prior to necessary maintenance dredging would minimize mussel impact.

Maintenance dredging to maintain navigation affects mussels living within or along the navigation channel. The channel is a permanent feature within 652 miles of the Tennessee River with specific requirements for its depth, width, and location. During high flows, the river substrate shoals at certain locations within the navigation channel, reducing its width and depth. These pinch points create grounding hazards for river traffic and, without maintenance, eventual occlusion of the channel. A few of these pinch points also provide suitable mussel habitat as evidenced by the mussel beds that often develop in these areas

Routine operations dredged mussels and substrate into full scows and disposed of the material in open water, generally in the back chutes of islands. Back chutes were selected because the original substrate was silt and sand. Disposed material provided optimal mussel habitat as documented by the fact that continued disposals into the back chutes of islands has been prohibited because large mussel beds have developed in these areas. The resulting beneficial effect of using dredged material for mussel habitat is the increase of mussel populations. This effect has been documented in the back chute of Wolf and Diamond Island where past disposal sites were colonized by mussels. However, full colonization at disposal sites appears to take many years to establish viable beds. This lag time could be the result of fragmenting the population with routine dredging operations.

The current mussel relocation method uses divers to hand remove mussels individually and relocate them, individually, to a new bed or comparable mussel habitat. For large beds (over one million mussels) removal could take several months in addition to stressing the mussels during collection, handling, transporting and placing mussels in appropriate habitat. A fast, efficient, and least damaging method of mussel removal would be needed to remove large communities (all size classes) of mussels in a way that would minimize handling stress, desiccation, air temperature exposure, transport, and include a portion of their existing habitat. This alternative method would be tested during the 2003 experiment. It does not use divers to remove mussels. It uses dredging equipment to move large numbers of mussels.

The effect of using the experimental mussel removal method (2003 experiment) over current routine dredging techniques, would likely result in less damage, fragmentation, burial, and lag time for mussels to develop into a viable community. The expected cumulative effect of continuing to use the experimental method several times would be beneficial. This method minimizes mussel stress, maximizes mussel community survival for all size classes, and expands mussel habitat in one action. Expanded habitat would increase mussel numbers including listed species. This effect could indirectly aid in endangered species recovery. Increased mussel numbers would also benefit the ecosystem by providing more food to organisms that feed on the mussels. Sustaining these communities sustains commercial and recreational musseling and the continued existence of listed species within the mussel community. Placement at appropriate disposal sites could expand viable mussel habitat resulting in a net gain of mussel resources.

From the human aspect, the risk of injury or even possible death would be greatly reduced because the need for divers would be greatly reduced. From a navigation aspect, the experimental mussel relocation method could be of great value to Corps districts that must maintain navigation channels with mussel resources that may or may not contain listed species. The same equipment that is used in dredging would be used in mussel relocation with modified operating procedures. Relocating large numbers of mussels by this method could be done relatively quickly in comparison to methods that use divers. The expected cumulative effect of using the experimental mussel relocation method for the Corps, could translate into tax dollar savings when compared to current mussel relocation methods employing divers.

Within the next 50 years, it is reasonably foreseeable that maintenance dredging will continue to be necessary as long as shoaling occurs within the authorized channel. Mussel beds that develop in the shoals can be avoided until the shoal becomes a navigation hazard. When hazards develop, maintenance dredging is unavoidable. Because of the small area affected and the precautions taken to protect all the mussels, performing the 2003 experiment is not likely to cause mussel resources to exceed a threshold of no return.

5.0 ENVIRONMENTAL COMMITMENTS

5.1 Environmental Safeguards

The 2003 EA has been sent to USFWS reporting the find of two listed species. One Fanshell (*Cyprogenia stegaria*) and four Pink muckets (*Lampsilis abrupta*) were collected during the 2002 experiment. None of these mussels were harmed. If appropriate measures are

implemented, impacts to the freshwater mussel populations and to the environment could be minimized. Actions that would be taken to minimize impact in the 2003 experiment include the following:

1. The 2003 experiment has been coordinated with appropriate state and federal agencies.
2. The 2003 experiment would implement redesigned protocols to capture data gaps.
3. QA/QC has been incorporated into the redesigned protocols.
4. The anticipated volume of dredged substrate disturbed in the 2003 experiment would be 100 cubic yards. This would be one-tenth of the riverbed substrate disturbed in the 2002 experiment (1,000 cubic yards).
5. The anticipated surface area affected by the 2003 experiment would be about $\frac{1}{4}$ acre. This is less than $\frac{1}{2}$ of the surface area disturbed in the 2002 experiment (slightly over $\frac{1}{2}$ acre).
6. The proposed activities would occur in the early fall. This would avoid fish and mussel spawning activities.
7. In September, the water temperature would be expected to exceed 60°F. Mussels are more mobile with warm water temperatures.
8. The Corps would employ divers to conduct preliminary 0.25 square meter quadrat sampling and timed searches within the selected dredge and disposal sites prior to any action to assess the resource.
9. Listed species found within the footprint of the proposed test sites would be handed over to TWRA for care.
10. The dredged material consists of clean and natural gravel and sand that does not carry contaminants at levels that would degrade water quality.
11. Dredged material would be placed in a single layer in the scow.
12. Dredged material would be maintained in a wet condition.
13. Dredged material would be taken to an area with appropriate depth and substrate composition.
14. Handling time would be kept to a minimum.

We believe that a clamshell dredging operation could be modified to minimize mussel mortality when all the safeguards are implemented.

6.0 CONCLUSION

The concept of moving large mussel beds with this experimental method has merit. The 2003 experiment would be necessary to capture data gaps and address discrepancies that were identified during the 2003 experiment. A scientific assessment at the conclusion of the 2003 experiment would help determine if this method could be considered as a viable mussel relocation method for large beds of mussels that must be moved to minimize impact from unavoidable maintenance dredging. Based on the analysis of this EA, Alternative 1 – Proposed Action – 2003 Experiment, is the alternative that best meets this goal and is therefore proposed alternative.

7.0 AGENCY COORDINATION AND ENVIRONMENTAL COMPLIANCE

7.1 Water Quality Certification

A Water Quality Certification (also referred to as an Aquatic Resource Alteration Permit) pursuant to Section 401 of the Clean Water Act, and pursuant to 33 USC 1341, must be obtained from the Tennessee Department of Environment and Conservation (TDEC) prior to open water placement of dredged material. Public Notice PM-P-03-02 serves as a request for this certification. It is anticipated that certification for the 2003 experiment would be equivalent and equally protective as the conditions issued for the 2002 experiment. Given the smaller size of the 2003 experiment, it would be expected that potential water quality impacts would be reduced. Therefore it would be expected that the 2003 experiment would be certified.

7.2 Endangered Species Act

The Endangered Species Act requires determination of possible affects on federally listed species or their critical habitat. Prior to the 2002 experiment, one Pink mucket (*Lampsilis abrupta*) was located and removed from the experimental site by TWRA. This find resulted in formal consultation with the USFWS. A Biological Opinion and Incidental Take was issued for the 2002 experiment. Data review determined that one Fanshell (*Cyprogenia stegaria*) and four Pink muckets (*Lampsilis abrupta*) were identified. These mussels were unharmed. They were handed over to TWRA for further care. Incidental take (one Fanshell and five Pink muckets) was not exceeded for the 2002 experiment.

The 2003 experiment is significantly smaller than the 2002 experiment. In comparison, the 2003 experiment would affect less than half of the substrate surface area, and one-tenth of the substrate volume and thereby significantly reduce the likelihood of encountering listed species. It would be therefore anticipated that under consultation, a Biological Opinion and Incidental Take would be issued for the 2003 experiment, which would be equivalent and equally protective as the requirements issued for the 2002 experiment. It would further be anticipated that the Biological Opinion for the 2003 experiment would conclude that the proposed 2003 experiment will not likely jeopardize the continued existence of federally listed species nor destroy or adversely modify any critical habitat.

7.3 Fish and Wildlife Coordination Act (FWCA)

Under this Act (FWCA - 48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) Federal agencies are required to consult and coordinate water resource project proposals with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and State wildlife agencies. This effort allows a holistic assessment of potential fish and wildlife impacts that could result with implementation of a federal action. The act facilitates strong consideration of the views of the resource agencies.

On February 13, 2003, an inter-agency meeting was conducted to review the implementation of the 2002 experiment and preliminary data. Participants and observers included representatives from TWRA, USFWS, USGS, TVA, and the Corps. During this meeting a coordinated effort was made to identify data gaps and QA/QC weaknesses. As a result, the attendants redesigned the protocols. The revised document, Proposed Redesigned Experimental Protocols, can be found in Appendix A. This coordination would be expected to continue through implementation, collection, analysis, and conclusion of the 2003 experiment. It is anticipated that these efforts would fulfill the provisions of the Act.

7.4 Cultural Resources Requirements

Section 106 of the National Historic Preservation Act of 1966 requires Federal agencies to take into account the effects of their activities on properties included in or eligible for the National Register of Historic Places. Regulations (36 CFR Part 800) require identification and evaluation of potentially affected historic properties, assessment of adverse effects, and resolution of adverse effects through consultation with the SHPO.

The proposed experimental site (Figure 2.) for the 2003 experiment is the same proposed site used for the 2002 experiment. It would be anticipated that in the opinion of the Tennessee SHPO, no National Register of Historic Places listed or eligible properties would be affected by the 2003 experiment. Therefore it would be expected that the SHPO would have no objections in proceeding with the 2003 experiment.

7.5 Environmental Justice Executive Order

Executive Order 12898 requires Federal agencies to promote “nondiscrimination in Federal programs substantially affecting human health and the environment.” In response to this direction, Federal Agencies must identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The 2003 experiment does not present a disproportionate adverse impact on minority, low-income households, or communities.

7.6 Clean Air Act and Clean Air Act Conformity Rule

The proposed maintenance dredging and disposal is subject to the Clean Air Act, as amended (432 U.S.C. 7401 et seq.). The proposed work would occur in an attainment zone for purposes of the Clean Air Act General Conformity Rule. The requirements of 40 CFR Part 51, Subpart W, apply to the proposed action. Section 51.853 of the Subpart lists exemptions to the general conformity provisions. The 2003 experiment would not be considered regionally significant and would not exceed the specified emission rates within the attainment area. The proposed 2003 experiment would be considered to conform to the State Implementation Plan.

7.7 Hazardous, Toxic and Radiological Wastes (HTRW)

The river substrate material at the proposed removal site consists of inert cobble, gravel and sand. Because contaminants do not generally adhere to material of large grain size, testing for the 404(b)(1) Evaluation would not be required. The proposed experimental site is believed to be clean so no additional testing has been proposed.

7.8 TVA Act

The proposed 2003 experiment is consistent with TVA’s responsibilities under the TVA Act to improve the navigability of the Tennessee River, and is consistent with its Environmental Policy and Principles to practice responsible stewardship of the Valley’s natural resources. In addition, it is consistent with the 1962 *Memorandum of Agreement between the Department of the Army and Tennessee Valley Authority for Construction, Operation, and Maintenance of Navigation Facilities on the Tennessee River and its Tributaries*. Under NEPA, TVA is a Cooperating Agency for the 2003 experiment.

7.9 Floodplain Executive Order

Executive Order 11988, Floodplain Management, requires federal agencies to evaluate and minimize impact on floodplains. This project does occur within the Tennessee River floodplain. However, there is no practical alternative to relocating mussels outside the river or its floodplain. Additionally, no obstruction would be created as a result of this project, therefore a 26a permit is not needed.

7.10 Wetlands Executive Order

Executive Order 11990, Protection of Wetlands, requires Federal agencies to protect wetlands. No wetlands would be affected by this project. Project activities are confined to open water.

7.11 Section 404 of the Clean Water Act (33 U.S.C. 1344)

This experiment is subject to Section 404 of the Clean Water Act. A Section 404(b)(1) evaluation for discharges of dredged or fill materials into the waters of the United States, has been prepared (Appendix B). The 404(b)(1) evaluation notes that the proposed discharge meets the requirements of the EPA Section 404(b)(1) Guidelines.

8.0 PUBLIC INVOLVEMENT

8.1 Scoping and Public Notice Notification

Public Notice, No. 02-03, was circulated on July 31, 2003. This notice served as scoping to solicit comments from the public, governmental agencies and officials, Indian Tribes, and other interested parties, that should be considered and evaluated with respect to potential environmental impacts of this proposed experiment. Comments regarding environmental issues would be addressed in the course of the NEPA process. The Public Notice also served as a Notice of Availability of the Environmental Assessment for this 2003 experiment. Appendix D contains the Public Notice and a list of postal and email addresses.

8.2 Consideration of Public Comments

Comments received regarding the 2002 experiment have been incorporated into the 2003 EA. An inter-agency meeting and several telecommunication exchanges between the Corps, USFWS, TWRA, USGS, TVA and TDEC resulted in an evaluation of 2002 experiment. This action resulted in the redesign and refinement of the proposed redesigned experimental protocols to capture missing data and reduce environmental and quality assurance concerns.

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10.0 LIST OF PREPARES

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APPENDIX A

PROPOSED REDESIGNED EXPERIMENTAL PROTOCOL

PROPOSED REDESIGNED EXPERIMENTAL PROTOCOLS
An Evaluation of Methods to Safely Remove Freshwater Mussels Prior to Maintenance Dredging

Introduction: The purpose of this document is to describe in a standard operating procedure for this experimental method in relocating mussels using dredging equipment. The performance of scientific evaluations and the collection of quality data would be necessary in order to evaluate mussel mortality associated with action of the clamshell bucket dredge. The Tennessee Wildlife Resources Agency (TWRA) would be performing quality control checks. The Malacologist In Charge (MIC) would be a scientist from a government organization. General conditions for this experiment are as follows:

A. Sorting process: Quadrat and clamshell bucket samples would be washed through a series of stacked screens sized 3, 1½, ½, and ¼-inch openings.

B. All mussels encountered would be:

• Identified.	• Measured by screen grouping. If time allows, some mussels would be measured with calipers.
• Counted.	• Checked, and general condition noted (includes abnormalities, cracks, chips, broken shells).
• Maintained in good health.	• Kept together per sample in tagged bags until returned to the river.
	• Handed over to the TWRA for care and relocation outside the test sites unless used for mark and recapture.

C. All **listed species** would be removed from the samples and handled separately. State and Federally listed species would be individually identified, counted, measured in length, aged (height and wet weight optional), and checked for general and reproductive (sexed) condition. Listed species would be handed over to the Tennessee Wildlife Resources Agency once data has been collected.

D. Quality Assurance/Quality Control (QA/QC) – A subset of the activities (as noted) would be redone to check for accuracy. TWRA would be filming underwater conditions. Filming would be a separate and independent action occurring when equipment and contract divers are out of the water.

E. The MIC (from a participating agency) would determine completion of an activity, and help develop a rating system to indicate level of injury, damage, or impact. The MIC would hand over all live animals not used for mark and recapture, to TWRA for care and relocation outside the test footprints.

F. TIME. The length of the experiment would be a total of 3 days, from start to finish, scheduled for the week of September 8, 2003.

G. As time allows, the next task can be initiated and completed regardless of Phase.

H. Contract divers must meet U.S. Army Corps of Engineers Safety and Health Requirements Manual (EM 385-1-1), Section 30 – Contract Diving Operations. All standard safety protocols related to field and barge work would be followed. (Safe diving advises river flows between 20-30 thousand cubic feet per second.)

I. CONTINGENCY PLAN: In the event something happens that would affect the Phases or Tasks of the experiment (weather, equipment failure, injury, illness), a meeting of the agencies represented on site, would determine the course of action. They would document reasons for deviations and modifications.

J. A pre-meeting would take places to discuss objectives and purpose of the study, as well as logistics, would be held with key personnel prior to fieldwork.

K. A safety meeting with divers would be held each day.

L. At the end of each workday, key personnel would meet to review the day's activities and plans for the remainder of the study.

M. A follow up meeting, to include all key personnel, would be held at an appropriate time after the field study has been completed and data have been analyzed.

PHASE I - Task I – Documenting Site locations and Existing Conditions		
	CORPS	Resources Agency QA/QC
1) Site selection	The purpose of this task is to delineate the dredge removal and placement sites. Coordinates would be recorded using a global positioning device (GPS) in a format useful to all agencies so that sites can be relocated accurately in subsequent years on printed maps.	TWRA would select test dredge and placement sites. Optimally, a placement site with few mussels. The experiment would take place within the same general area used for the September 2002 study, possibly moving either immediately upstream or downstream of the previous experimental locations.
2) GPS Coordinates	The Corps would log GPS coordinates for all site locations in Degree, Minute, Second, using Datum 1983. Points would be identified on a digital USGS Topographical Map. . <u>CONTRACT DIVERS:</u> Divers would verify test dredge and disposal locations with the MIC. Divers would note ease of relocating the test sites above and below the water.	
a) Survey Area	The Corps Survey boat would conduct a bathymetric survey to map the existing bottom at the dredge and placement areas.	
b) Boundary Marking	The Corps would mark dredge and placement site boundaries, and scow disposals lines with appropriate temporary marking (example: PVC, chains, floats, etc.) for easy relocation above and below water <u>CONTRACT DIVERS:</u> Divers would secure up to 3 chains/cables/ropes (provided), or other appropriate markings across the original substrate in the test disposal area, running horizontally with the riverbank.	
c) QA/QC	A subset of the GPS coordinates would be rechecked with a second GPS unit. QA/QC would be coordinated with a participating agency.	After the test dredge and placement sites have been marked, TWRA would videotape the sites underwater to document existing conditions.

PHASE I - Task II – Preliminary Evaluation – Quadrat Sampling in Removal and Placement Sites.		
Preliminary 0.25 square meter Quadrats sampling – Estimating mussel density		
	CORPS	Resource Agency QA/QC
1) Quadrats		
a) Collection	<p>The purpose of this task is to characterize density, evidence of recent recruitment, and relative species abundance, using quantitative methods, of mussels in the dredge and placement sites.</p> <p>CONTRACT DIVERS: Divers would collect 20 (40 total) substratum (0.25 square meter) quadrats at each of the two sites (dredge and placement sites). Material would be placed in a 5-gallon bucket, hoisted to the surface, and processed at an appropriate site.</p>	
b) Sorting Process	<p>CONTRACT DIVERS: Each quadrat sample would be washed (using water pumps) through a series of stacked graded screens (See Note A). All mussels would be removed and maintain in good condition. All mussels would be given to the MIC for further processing.</p> <p>The MIC would identify, count, size by screen groups (measure individually if time allows), note condition, and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling to reduce stress* (See Note C.)</p>	TWRA would verify identifications, counts, and general condition of the mussels.
c) Marking	The MIC would identify a subset of non-listed mussels for a mark and recapture experiment using battery operated dremel tools or similar device.	
d) QA/QC	CONTRACT DIVERS: A portion of the sieved material would be retained and re-sieved to indicate accuracy of that process and mussel picking efficiency.	.
e) Completion	The MIC would consult with TWRA to determine task completion and when to discard all sieved material. All mussels not used in the experiment would be handed over to the TWRA.	TWRA would take possession of all unmarked mussels for care and relocation outside the test footprints.

PHASE I - Task III – Preliminary Evaluation –Timed Searches in Removal and Placement Sites		
	CORPS	Resource Agency QA/QC
1) Timed Searches		
a) Time	<p>The purpose of this task is to use qualitative collection methods to obtain information on relative species abundance and presence of uncommon (listed) mussel species.</p> <p>CONTRACT DIVERS: Four – 15 to 30 minute searches would be conducted in the dredge and placement sites. Divers would attempt to collect all live mussels without size bias, as it is difficult to discern endangered species underwater. Divers would hand mussels over to the MIC. Report results as catch per unit of effort (CPUE). This would allow before and after comparisons. All mussels would be hand over to the MIC.</p>	
b) QA/QC	MIC would compare results from different divers working in the same area to determine search efficiency.	
c) Sorting Process	MIC would identify, count, size by screen groups, note condition, and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling. (Note C.)	TWRA would verify identifications, counts, and general condition of the mussels.
d) Marking	MIC would retain a subset of non-listed mussels for marking as in Phase II, Task IV.	
e) Completion	The MIC would consult with TWRA to determine task completion. All mussels not used in the experiment would be handed over to the TWRA.	TWRA would take possession of all unmarked mussels for care and relocation outside the test footprints.

PHASE II - Task IV – Clamshell Bucket Scoop Evaluation. Dredge bucket impact (inside)		
Clamshell Bucket Scoops – Full and Partial scoops		
	CORPS	Resources Agency QA/QC
1) Seeding	<p>The purpose of this task is to examine recently dredged material to assess the number of mussels that are either damaged or killed. Assessment would be made based on a developed rating system. Results would be expressed as the number damaged or killed, compared with the total collected from each scoop.</p> <p>CONTRACT DIVERS: Marked non-listed mussels would be distributed within the test dredge area in a pre-determined pattern and density for mark and recapture.</p>	
2) Bucket Scoop		

a) Collection	1-3 partial scoops and 1-3 full scoops of bottom material would be collected with a clamshell dredge bucket in the removal area. Each bucket scoop would be placed on a flat barge one at a time. This material would be maintained in a wet condition.	TWRA would film the impact of scoop depressions noting partial or full scoop depression.
b) Sorting Process	<p>Before processing, and as the work proceeds, the dredged material would be carefully inspected and all living and recently damaged mussels would be removed by hand as they are observed. Each dredge bucket scoop would be considered a single sample. Sediments from the scoop would be continuously run through the stations.</p> <p>CONTRACT DIVERS: Dredged material would be carefully shoveled from the deck and placed on the top of a nested screen series and processed as in Phase I Task II above. The material would be hosed with river water to wash the sediment through the screens. Stacked screens would be set within a containment area to capture fine sediment washed through the screens. Full screens with washed sediment would be separated by screen size and carried to respective sorting tables. Mussels would be picked from screen trays. Mussels would be maintained in good health. Mussels would be carried to the MIC sorting table for further processing.</p> <p>MIC would identify, count, size by screen groups (measure individually as time allows), note condition and marking and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling. (Note C)</p>	TWRA would verify identifications, counts, and general condition of the mussels.
c) QA/QC	CONTRACT DIVERS: A portion of the sieved material would be examined for mussel picking efficiency and washed fines would be sub-sampled using a tray with 1/8 inch mesh to determine small mussel recovery.	
d) Completion	The MIC would consult with TWRA to determine task completion and when to discard all sieved material.	TWRA would take possession of all mussels not used in the experiment and relocate them outside the test footprints.

PHASE II - Task V – Bottom Evaluation – Quadrat Sampling in Dredged Site. Dredge bucket impact (outside)		
	CORPS	Resources Agency QA/QC
1) Post-dredged 0.25 meter Quadrats and Timed Searches		
a) Collection	<p>The purpose of this task is to use quantitative methods to assess the number of mussels that remain or are injured on the river bottom below the bucket scoop depth.</p> <p><u>CONTRACT DIVERS:</u> Divers would collect up to 8 – 0.25 quadrats out each test dredge scoop depression on the river bottom. Divers would describe all underwater conditions while samples are taken. Note partial or full scoop depression. Material from each quadrat would be placed in a 5-gallon bucket and hoisted to the surface for processing.</p> <p>Divers would conduct timed searches over the entire scoop depression after quadrats have been taken. Record as CPUE for comparisons.</p>	
b) Sorting Process	<p><u>CONTRACT DIVERS:</u> Each quadrat would be washed (using water pumps) through a series of stacked graded screens (See Note A.). All mussels would be removed and maintain in good condition and given to the MIC.</p> <p>The MIC would identify, count, size by screen groups (measure individually if time allows), note condition, and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling to reduce stress* (See Note C.)</p>	TWRA would verify identifications, counts, and general condition of the mussels.
c) QA/QC	<u>CONTRACT DIVERS:</u> A portion of the washed fines would be sub-sampled to determine small mussel recovery.	
d) Completion	The MIC would consult with TWRA to determine task completion and when to discard all sieved material.	TWRA would take possession of all unmarked mussels for care and relocation outside the test sites.

PHASE II - Task VI – Clamshell Dredge Removal Efficiency		
	CORPS	Resources Agency QA/QC
1) Clamshell Dredge Scoop Samples		
a) Dredging	<p>The purpose of this task is to study effects of full and partial bucket dredging and placement in the river.</p> <p>The clamshell dredge bucket would be operated according to normal procedures. Separate areas would be used within the test dredge footprint for full and partial bucket removals. Light scoops would be placed in a single layer in one dump scow containing water. The dump scow would be moved to the placement site and the material deposited. The scow would be returned to the dredge site and Full scoops would be placed in a single layer within a dump scow containing water. The dump scow would be moved to the placement site and the material deposited.</p>	
b) Survey Area	On completion of the dredging, the Corps Survey boat would conduct a bathymetric survey to map the new bottom topography at the dredge area.	On completion of the dredging, TWRA would film the new bottom topography.
c) Bucket Evaluation	CONTRACT DIVERS: Divers would inspect the partial bucket and full bucket dredge areas. Four 15 to 30 minute timed searches would be conducted to evaluate dredge bucket removal efficiency and to collect any remaining and damaged mussels. Record as CPUE for comparisons.	
d) Completion	This activity would be complete when the dump scow disposals are complete and the scow is out of the area.	

PHASE III – Task VII – Dump Scow Placements - Post-Placement Evaluation (Within 48 hours) Timed Searches		
	CORPS	Resources Agency QA/QC
1) Post Placement – Timed Searches		
a) Placement	Each time, the scow would align perpendicular to the bank. It would slowly open the hull and back up to disperse the dredged material in a thin layer.	
b) Survey Area	On completion of the disposals, the Corps Survey boat would conduct a bathymetric survey to map the new bottom topography at the disposal site.	On completion of the disposals, TWRA would film the new bottom topography.

c) Timed Searches	<p>The purpose of this task is to use qualitative methods to collect mussels from dredged material piles in the placement areas so investigators can examine mussel damage <i>in situ</i>.</p> <p><u>CONTRACT DIVERS:</u> Divers would conduct four 15 to 30 minute searches over all the discernable disposed material. All mussels and freshly cracked, chipped or broken shells would be brought to the surface, as it is difficult to discern endangered species underwater. Record as CPUE for comparisons. All material would be given to the MIC.</p>	
d) Sorting Process	MIC would identify, count, size by screen groups, note condition, and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling. (Note C)	TWRA would verify identifications, counts, and general condition of the mussels.
e) Completion	The MIC would consult with TWRA to determine task completion.	TWRA would take possession of all unmarked mussels for care and relocation outside the test sites.

<u>PHASE III - Task VIII – Post-Placement Evaluation (Within 48 hours) Quadrat Sampling</u>		
	CORPS	Resources Agency QA/QC
1) Post-Placement 0.25 meter Quadrats		
a) Collection	<p>The purpose of this task is to use quantitative methods to obtain an estimate of density and to evaluate the new distribution patterns and condition of dredged mussels transported by the scows.</p> <p><u>CONTRACT DIVERS:</u> Divers would collect twenty 0.25 square meter quadrats from the disposed material in the placement footprint. Using the chain/cable/rope, note depth of disposed material over the original substrate when collecting the quadrats. Note location and mussel position in the substrate especially for of any marked mussels collected.</p>	
b) Sorting Process	<p><u>CONTRACT DIVERS:</u> Material from each quadrat would be placed in a 5-gallon bucket and hoisted to the surface for processing through a series of stacked screens (See Note A). Pick mussels out of screens and maintain in good condition. Hand over all mussels to the MIC.</p> <p>MIC would identify, count, size by screen groups, note condition, and bag mussels. The MIC would maintain all mussels in good health and remove State and Federal listed species for separate handling. (Note C)</p>	TWRA would verify identifications, counts, and general condition of the mussels.

c) QA/QC	CONTRACT DIVERS: A portion of the washed fines would be sub-sampled to determine small mussel recovery. The fines would be washed through a tray with 1/8 inch mesh.	
d) Completion	The MIC would determine when this task is complete.	TWRA would take possession of all mussels for care and relocation outside the test footprints.

PHASE III -Task IX – Documentation.		
	CORPS	Resources Agency QA_QC
1) Data Reports	The MIC would generate the reports. All field data sheets would be put in electronic format. A progress report would be submitted to the participating agencies within 2 months of the field surveys. A final report summarizing the results of the whole project would be submitted to the participating agencies within 4 months. Within 30 days of report completion, all participating agencies would meet and discuss the project and major findings.	
2) Success Criteria	<ul style="list-style-type: none"> • Time – survival rate within 48 hours and 12-14 months later. • ~ % Survival in scoops examined in detail • ~% Removal efficiency – Comparison of pre post survey results • ~ % Mortality at the removal site • ~ % Survival at relocation site <p>The overall impact of this method is based on impacts to the mussel fauna. Negative impacts include mortality and significant shell damage. It may be possible that impact estimates may be species and size specific. Impacts would be assessed 1.) Dredge material within the bucket; 2.) Dredged material outside the bucket; 3.) And, dredged material placement. Some mortality and shell damage information may be obtained from the marked and replaced mussels. Some general information on efficiency of dredge bucket removal can be obtained by diver observations and sampling in the removal area after dredging has taken place.</p> <p>The impacts of the dredge on mussels in this method are obviously related to the percentage of mussels killed or damaged by this method. To put this into perspective, a comparison can be made with the percentage of mussels that are likely to be obtained by hand (collection efficiency) using divers.</p>	

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APPENDIX B

SECTION 404(b)(1) EVALUATION

(Separate .pdf document under review.)

APPENDIX C

PUBLIC NOTICE NUMBER PM-P 03-02
(Separate .pdf document under review.)

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APPENDIX D

RESPONSES TO

PUBLIC NOTICE NUMBER PM-P 03-02

**(Compiled after the public review.
To be incorporated in final document.)**

APPENDIX E

WATER QUALITY CERTIFICATION

(In process. To be incorporated in final document.)